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ERS-1 SATELLITE MEASUREMENTS OF WEDDELL SEA ICE MOTION AND DEFORMATION DURING ICE STATION WEDDELL-1

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Polar region ocean-atmosphere heat exchange is regulated by the opening and closing of the sea-ice cover. Ice motion in response to wind and currents, and the resulting deformation is presently monitored using satellite microwave synthetic aperture radar (SAR) . The ERS-1 SAR acquired mesoscale (100km) timeseries data in late austral summer, fall-freeze up in 1992. High resolution (30m) image acquisitions were scheduled to coincide with deployment and execution of a manned drift station in the perennial ice cover of the south-western Weddell Sea between 7 February and 15 March 1992.

15 Pairs of overlapping SAR images separated in time by 1-3 days are geolocated and coregistered to enable automatic tracking of ice around Ice Station Weddell (ISW-1). Resulting ice--displacement vectors are geolocated on a 100km grid with a 5km spacing and used to generate partial derivatives of ice velocity in areas of contiguous grid cells. Measured drift speeds of ice floes and open water production or ice deformation rates are validated using GPS measurements made at ISW-1 and surrounding Argos buoy positions. Examples indicate details of divergence, vorticity and shearing. Statistics of the ice motion yield a mean ice-drift speed of 7.45+/-1 .37 cm/s, on a bearing 273 degrees, with a mean temperature of -9.6 deg. C and wind speed of 5.0 m/s. Ice concentrations during the drift varied with opening and closing around a mean value of **97%.** A mean net divergence of **0.6%** indicates a negligible dilation in the ice-covered area, with opening and closing events redistributing the ice mass. Corresponding rotation and shear values are -0.023+/-0.3 *10A-6 1/s, and 0.65+/-0.5 *10*-6 1/s, respectively.

This time-series together with opening and closing and meteorological information is being used to estimate regional momentum and heat fluxes. Results indicate the radar-imaged ice cover responds sensitively to top and bottom forcing. These advances in measuring the dynamics, and growth and decay of sea ice bring significant benefits to the study of high-latitude ocean processes.

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